

PATENT  
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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant : Chun-Byung Yang  
Serial No. : 10/598,170  
Filed : April 23, 2007  
Title : PREPARATION METHOD OF SOLID TITANIUM CATALYST FOR  
OLEFIN POLYMERIZATION  
Examiner : Choi, Ling Siu Art Unit: 1796

Assistant Commissioner for Patents  
Washington DC 20231

## **RESPONSE TO NON-FINAL OFFICE ACTION**

Dear Sir:

In reply to the Office Action dated July 10, 2008, the Applicant submits the following Response and Amendment.

A listing of Claims 1-5 begins on Page 2; and

Remarks begin on Page 4.

What is claimed is:

1. (original) A preparation method for a solid titanium catalyst for olefin polymerization, which comprises the steps of:

(1) preparing a magnesium compound solution by dissolving a magnesium halide compound into a mixed solvent of a cyclic ether and one or more of alcohol;

(2) preparing a carrier by, adding a mixture of titanium compound having a general formula of  $Ti(OR)_aX_{(4-a)}$ , in which R is an alkyl group having 1-10 carbon atoms, X is a halogen atom and a is an integer of 0-4, and halogenated hydrocarbon with the molar ratio of the halogenated hydrocarbon: the titanium compound being 1:0.05 - 1:0.95, to the magnesium compound solution at -70 - 70°C and then elevating the temperature for reaction; and

(3) preparing a solid titanium catalyst by reacting the carrier with a titanium compound and an electron donor.

2. (original) The preparation method for a solid titanium catalyst for olefin polymerization according to claim 1, characterized in that the cyclic ether used in the step (1) is tetrahydrofuran or 2-methyltetrahydrofuran, and the one or more of alcohol used in the step (1) is primary or polyhydric alcohol having 2-12 carbon atoms.

3. (previously presented ) The preparation method for a solid titanium catalyst for olefin polymerization according to claim 1, characterized in that the molar ratio of the cyclic ether: the one or more of alcohol used in the step (1), is 1:0.1 - 1:10.

4. (original) The preparation method for a solid titanium catalyst for olefin polymerization according to claim 1, characterized in that the halogenated hydrocarbon used in the step (2) is a halogenated hydrocarbon having 1-20 carbon atoms containing at least one halogen.

5. (previously presented) The preparation method for a solid titanium catalyst for olefin polymerization according to claim 2, characterized in that the molar ratio of the cyclic ether: the one or more of alcohol used in the step (1), is 1:0.1 - 1:10

## REMARKS

The Examiner submitted a non-final Office Action dated July 10, 2008 to the Applicant. Claims 1 –5 were pending in the Application. The Examiner rejected Claims 1-5.

In response, the Applicant has not amended Claims 1-5. Accordingly, Claims 1-5 remain pending in the present application. The Applicant submits that based upon the remarks below, Claims 1-5 are in condition for allowance.

### Claim Rejections Under 35 U.S.C. §103(a)

Claims 1-5 are rejected under 35 USC §103(a) as being unpatentable over Yang et al. (U.S. Patent No. 6,034,025) in view of Kioka et al. (U.S. Patent No. 4,330,649). The Applicant submits the following arguments in support of Claims 1-5 over the prior art cited.

The present invention relates to a preparation method of solid titanium catalyst for olefin polymerization. The method is comprised of the steps: (1) preparing a magnesium compound solution by dissolving a magnesium halide compound into a mixed solvent; (2) preparing a carrier by reacting the magnesium compound solution with a titanium compound and halogenated hydrocarbon; and (3) preparing a solid titanium catalyst by reacting the carrier with a titanium compound and an electron donor. The main feature of the present invention is preparing the carrier containing magnesium and titanium through the steps (1) and (2) before finally preparing the catalyst by reacting titanium compound with the carrier through the step (3).

The present invention, in contrast with the inventions disclosed by Yang and Kioka, has a distinct constitution in that the carrier is prepared by reacting the magnesium compound solution with titanium compound and halogenated hydrocarbon in the step (2).

### YANG

Yang does not disclose using halogenated hydrocarbon as disclosed in step (2) of the present invention. The difference in effect of using halogenated hydrocarbon in the step (2) is shown in the table 1 of the Example in the specification of the present invention. The Examples in Table 1 used halogenated hydrocarbon in the step (2) and the Comparative Examples didn't use halogenated hydrocarbon as in the method of Yang. As shown in Table 1, which is represented in the Example in the specification of the present invention (page 5, [0054]), comparing the results from the Examples of the present invention with those from the

Comparative Examples like the method from Yang's invention, it can be understood that the resulting data from the Examples of the present invention is superior to those from Comparative Examples in characteristics like catalyst production yield, average catalyst particle size, polymerization activity, isotactic index, and bulk density.

Therefore, the present invention has different construction from that of Yang, and has more conspicuous effect than Yang, and the present invention cannot be easily invented by one of ordinary skill in the art by reading Yang.

#### KIOKA

The method of preparing catalyst from Kioka consists of three steps: (a) preparing a magnesium compound in a liquid state and (b) preparing by direct reacting the magnesium compound with a titanium compound in liquid state. In other words, Kioka discloses a method for preparing a catalyst incorporating titanium into a carrier bearing magnesium as a major component.

In contrast to the present invention, Kioka does not disclose the step (2) of the present invention for preparing a carrier. Although Kioka discloses, in the step (a) which corresponds to step (1) of the present invention, the step of preparing liquid magnesium compound by contacting the magnesium compound with an electron donor under the presence or non-presence of hydrocarbon solvent which can dissolve the magnesium compound, wherein halogenated hydrocarbon being one example of the hydrocarbon solvent (Column 4, line 62 – Column 5, line 15). In other words, Kioka only discloses halogenated hydrocarbon as just one example of hydrocarbon solvents that can be used in step (a) corresponding to the step (1) of the present invention, but not the use of the halogenated hydrocarbon in preparing the carrier by reacting the magnesium compound solution and titanium compound as in the step (2) of the present invention.

Also, the background art in the specification of the present invention recites defects from the catalyst prepared without the step (2) of the present invention like Kioka's invention. As stated above, the catalyst prepared using Kioka's invention has the defects in which catalyst production yield is low and catalyst properties are not satisfying enough, regarding its morphological properties such as catalyst shape, size, and size distribution, and further complement or improvement in stereoregularity of the obtained polymers is also required (page 1, [005] in the specification of the present invention).

Therefore, the present invention has solved the problem of the prior art, such as Kioka, by adopting the technical construction of using halogenated hydrocarbon in the step (2), and is not obvious by one or ordinary skill in the art upon reading Kioka.

Since the step (2) of Yang does not use halogenated hydrocarbon, and is substantially different from step 2) of the present invention, the construction of the present invention is substantially different, and not the same as, the combination of Kioka and Yang and thereby not obvious from the combination of the Yang and Kioka. Therefore, Claims 1-5 are not obvious in light of Yang in view of Kioka.

Based upon the arguments above in support of Claims 1-5, the Applicant requests that the rejection under 103(a) be withdrawn. Claims 1-5 are now believed to be in condition for allowance.

Corresponding action is respectfully solicited.

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The Examiner is encouraged to contact the undersigned to discuss any issues related to this application at (401) 273-4446.

Respectfully submitted,

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